

Directions:

1. Mark your confusion.
2. Show evidence of a close reading. Mark up the text with questions and/or comments.
3. Write a one-page reflection on your own sheet of paper.

Cleaning Up the Trash in Space

The Earth is surrounded by an ever-growing cloud of space junk. Is it too late to take out the extraterrestrial trash?

Source: *The Week*, October 14, 2011

How much junk is up there?

Since the space age began with the launch of Sputnik 54 years ago, we've turned the region just above Earth's atmosphere into a giant scrap yard, littered with everything from exploded rockets to tools lost during space walks. The U.S. Space Surveillance Network is currently tracking some 22,000 pieces of orbital trash that are at least 4 inches across. NASA estimates that tens of millions of smaller, non-trackable objects are circling the Earth, such as screws and flecks of spacecraft paint. It can take centuries, but everything that goes up comes down. Smaller trash burns up on re-entry; larger objects can reach the ground. That was the case last month, when a 6-ton NASA satellite made a fiery descent through the atmosphere and splashed into the Pacific Ocean. With more and more countries lobbing satellites into space, Earth's orbit is filling up with waste faster than gravity can empty it. "The problem is worse now than it was 10 years ago," says NASA engineer LeRoy Cain. "In 10 years it will be worse still." Even if humanity never sends up another rocket, the number of stray objects will continue to climb.

Why might that happen?

There's so much debris in orbit, says the National Research Council in a recent study, that it could set off a "collision cascade": an unending chain reaction in which pieces of junk collide and create more debris, which in turn causes more collisions and debris. This runaway process could create a clutter barrier in space that would make it difficult to operate the satellites that enable our communications, meteorological, and GPS systems. "We've lost control of the environment," says retired NASA scientist Donald Kessler, who wrote the NRC study.

What makes the junk a hazard?

Most space debris flies at or near an orbital velocity of 17,500 miles per hour. At that speed, even a tiny bolt can cause massive damage. "If one collides with a satellite or another piece of debris at the not-unreasonable relative velocity of, say five miles per second, it will blow it to smithereens," says NASA engineer Creon Levit. The International Space Station has been fitted with more than 100 shields made from layers of aluminum, ceramic, and Kevlar fiber that can withstand strikes from objects measuring 0.4 inches and smaller. But in April the ISS had to maneuver to avoid a large piece of debris — the fifth time since 2008 it was forced to do so. Two months later, the six-man crew rushed to their Soyuz escape pods when a small hunk of junk hurtled toward the station. The debris passed within 1,100 feet of the station, its closest shave yet. Other satellites make maneuvers almost daily to avoid collisions, costing them precious fuel and shortening their lifespans.

Can't we stop the buildup?

In 1981, NASA tweaked the design of its rockets so they would no longer explode into hundreds of pieces after delivering payloads into orbit. The Europeans, Russians, and Chinese followed suit over the next decade, and it appeared as though the space junk problem had been largely contained. That all changed in 2007, when China blasted apart a defunct weather satellite with a missile, creating 150,000 new pieces of debris, 3,118 of which are large enough to be tracked from the ground. Then, in 2009, the retired Russian communications satellite Cosmos 2251 smashed into a working satellite owned by the U.S. firm Iridium. The collision created another 2,000 big chunks of orbiting scrap. "Those two single events doubled the amount of fragments in Earth orbit, and completely wiped out what we had done in the last 25 years," says Kessler.

Is it possible to remove the junk?

The U.S. Air Force is developing a \$1 billion "Space Fence" radar system to track debris as small as 0.4 inches and supply advance warnings to satellite operators. But there's a growing consensus that monitoring the problem isn't enough — someone needs to take out the trash. The European Space Agency has suggested sending up a probe to spray old boosters and satellites with expanding foam. The foam would increase the junk's atmospheric drag, ensuring a quicker re-entry into Earth's atmosphere. ESA scientists say their plan could remove the 50 largest pieces of junk within 30 years. NASA, meanwhile, has suggested using Earth-based lasers to nudge large pieces of space junk off collision courses.

When will the cleanup start?

At the moment, all the junk-busting gadgets are still doodles on the drawing board. But even if we had the technology at hand, no nation has the legal right to launch a mass cleanup of space. "You can't take, touch, or salvage space objects from another country," says Joanne Gabrynowicz, a space-law expert at the University of Mississippi. That's a big problem, since only 29 percent of the clutter is American, while 37 percent is Russian and 28 percent Chinese. The international community isn't likely to resolve this legal quandary anytime soon. "The U.N. Committee on the Peaceful Uses of Outer Space are still arguing about where space begins," says Victoria Samson of the Secure World Foundation, a lobbying group. That's "the same argument they've been having for 40 years."

Getting hit by falling garbage

NASA estimates that at least one piece of trash hits the Earth's surface every day, but only one person is known to have ever been struck. Lottie Williams was strolling in a Tulsa park in 1997 when she saw a fiery streak in the sky and felt something tap her on the shoulder. It turned out to be a metal strip from a Delta II rocket, about the weight of "an empty soda can," she says. So don't panic next time a satellite re-enters the atmosphere. The European Space Agency estimates that in the course of a typical 75-year lifetime, the risk of being injured by space junk is less than one in 1 billion. In comparison, the lifetime risk of being struck by lightning is around one in 80,000.

Reflection ideas:

- Why should we care about junk in space?
- What other environmental issues should concern us? Explain.